

Pollution Prevention at Los Alamos National Laboratory

Chemical Management at TA-48

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Environmental Stewardship Office

The Challenge

Excess chemicals must be disposed of as hazardous waste. Although the Laboratory has conducted major campaigns to eliminate excess chemicals, excess chemicals continue to accumulate and must be disposed of. Disposal is expensive and time consuming. In early FY-2001, it became apparent that the Chemistry (C) Division laboratories at TA-48 needed to dispose of a large number of excess chemicals. The Environmental Stewardship Office challenged C-Division to reduce the number of excess chemicals requiring disposal. C-Division responded to this challenge by agreeing to apply the Green Zia systems approach to address this problem.

This paper will discuss how the C-Division team used the following tools to address the issues involved with excess chemicals:

- Determining opportunities in the current process using process maps
- Rank ordering of the opportunities to improve the process using Pareto analysis and activity based costing.
- Determining the root cause of the selected opportunity using a cause and effect (fishbone) diagram.
- Posing a consensus problem statement for generating process alternatives
- Generating process alternatives
- Selecting alternatives using a forced pairs comparison
- Implementing the selected alternatives with a formal action plan

TA-48 Excess Chemical Team

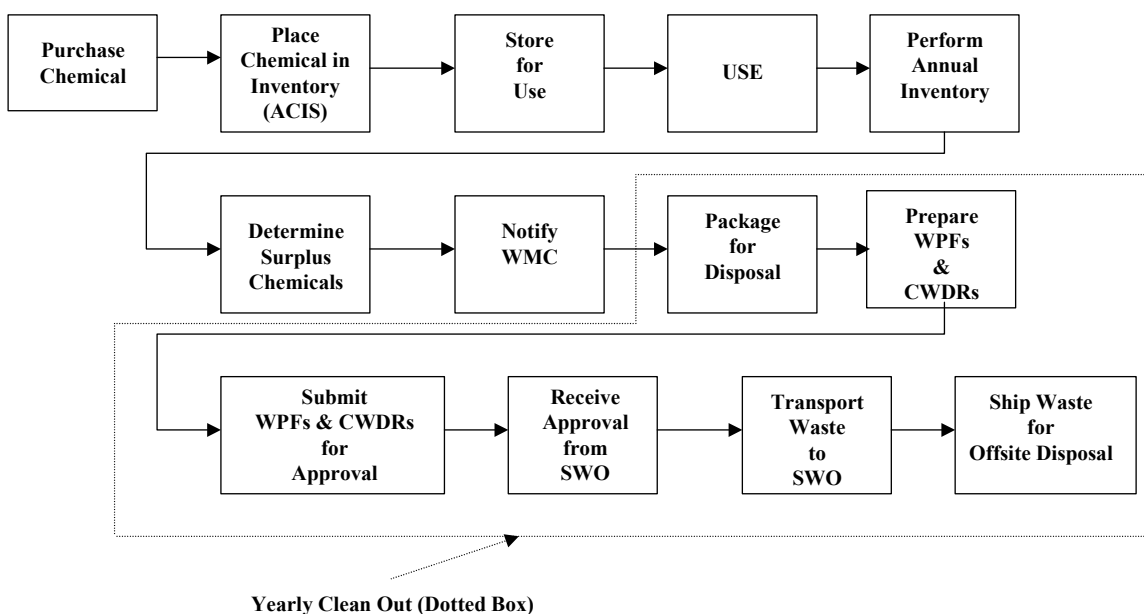
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Process Mapping

The team prepared a process map for the purchase, excess, and disposal of hazardous chemicals (see Figure 1). Chemicals are purchased through the Just in Time (JIT) system or via Purchase Requisition (PR). When the chemical is received, the chemical is logged into the Automated Chemical Inventory System (ACIS). The chemical is then stored for

use, used, and inventoried annually. When the chemical is no longer needed, the chemical is marked surplus and the process to dispose of the chemical is begun. The chemical owner notifies the Waste Management Coordinator (WMC), the waste is packaged, and Waste Profile Forms (WPFs) and Chemical Waste Disposal Requests (CWDRs) are prepared. After this documentation is approved, the waste is shipped to Solid Waste Operations (SWO) for disposal. An alternative to this process is to perform a yearly cleanout (see the dotted box). During a clean out, SWO sends representatives directly to the facility, the paper work is prepared and the chemicals are shipped directly off-site for disposal, dramatically reducing the effort required.

Figure 1



Rank Ordering of Opportunities

Costs associated with the different process steps are difficult to determine because they are so dependant on the amount of material being processed. The waste management costs are fixed based on the weight of the waste at \$5.92/kg. Based on the purchase and disposal of 100 excess chemicals each having an average weight of 0.5 kg, the following costs were developed. For ease, it was assumed that the average 0.5 kg bottle of reagent grade chemical costs \$50.00.

Activity	Labor Hours	Cost
Purchase Chemicals (100, 5 minutes each)	8.3	415
Purchase Cost (100, \$50/each)		5,000
Inventory (100, 1 minute each)	1.7	85
Package (5 drums)	4	200
Prepare WPFs (100, 20 minutes each)	33	1650
Prepare CWDRs	1	50

Load and Transport to SWO	2	100
Waste Disposal Cost (50 kg* \$5.92/kg)		296
Total		\$8396

The costs listed in this table are depicted in Figure 2.

Figure 2

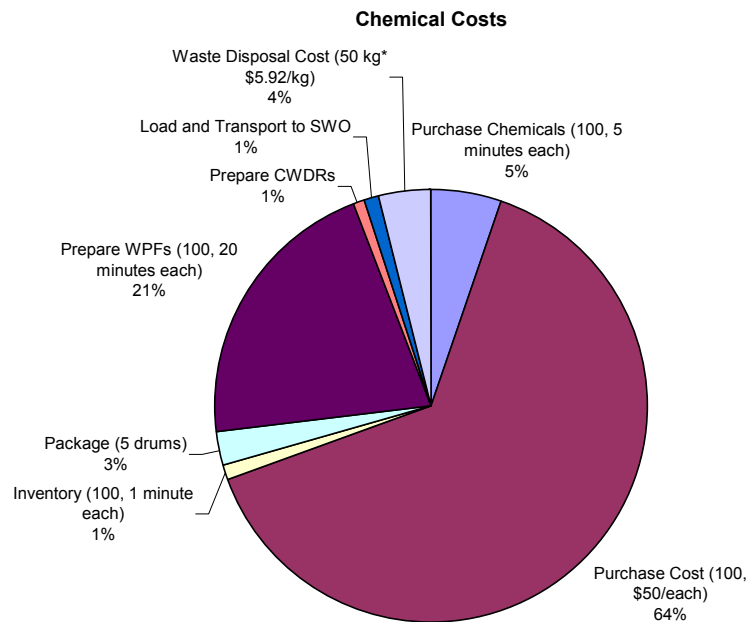
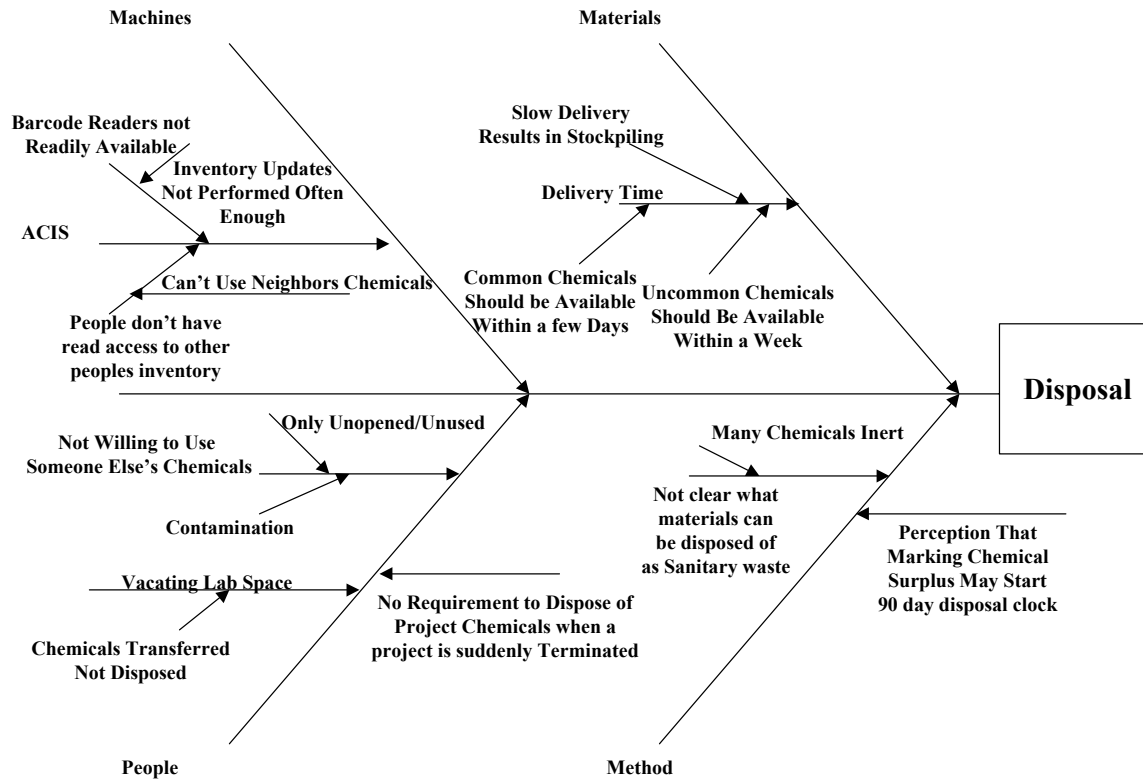


Figure 2 clearly illustrates, that the cost of the chemical and the disposal costs are large compare to the costs required to maintain the chemical inventory. Of the disposal costs, the cost to prepare the WPFs is by far the biggest expense. Elimination of the generation of excess chemicals represents the best opportunity. This saves both the purchase and disposal costs. In addition, cost associated with the preparation of WPFs can be largely eliminated by performing annual clean out activities.

Root Cause Analysis and Statement of Problem

The team examined the issues associated with excess chemicals with a cause and effect diagram to identify potential causes of the problem. The diagram is presented in Figure 3.

Figure 3



The following is a detailed list and description of the items present on the cause and effect diagram.

- **Barcode Readers not Readily Available:** An up to date inventory is critical to assure that excess chemicals are identified and made available for reuse. The unavailability of bar code readers makes it inconvenient to perform inventory updates more often to identify excess chemicals.
- **Delivery Time:** The lead time on the procurement chemicals is too long. Because of the long lead times, it creates the tendency to stockpile certain chemicals to ensure a ready supply.
- **Common Chemicals not Readily Available:** The JIT chemical supplier should maintain a ready stockpile of commonly used chemicals to prevent the tendency for individual users to stockpile these items.
- **Not willing to use Someone Else's Chemicals:** People are hesitate to use someone else's chemicals if the chemicals have been open for the fear of contamination.
- **No Requirement to Dispose of Project Chemicals when a project is suddenly Terminated:** When projects are suddenly terminated, no funds are made available to dispose of the left over chemicals.
- **Vacating Lab Space:** When a person vacates a lab space they are supposed to disposition all of their chemicals. Technically this should require that they dispose of

the left over chemicals or transfer them to someone else who can use them. However, since funds are not typically available for disposal, all of the chemicals are typically transferred to someone else who must deal with the eventual disposal issues.

- Not clear what materials can be disposed of as Sanitary Waste: Many laboratory chemicals are inert and can be disposed of as sanitary waste. For example moisture absorbents for air drying. A clearer definition of what materials can be disposed of as sanitary waste needs to be made available to waste generators.
- Making Chemicals Surplus May Start the 90 day disposal clock: Generators are concerned that by marking chemicals excess in the ACIS system may start the 90 day disposal clock. Because of concern over this issue, most generators are not using this feature of the ACIS system.
- People don't have read access to other people's inventory: Currently, the ACIS system only allows a user to look at their own chemical inventory unless another user has marked their chemicals excess.

Team members were requested to review the results of the root cause analysis and prepare a statement that captured what each person thought were the major issues involved in the generation of excess chemicals requiring disposal. The following consensus statement of the problem was prepared.

Excess chemicals are currently being disposed of as hazardous waste. This is a significant problem because of the costs associated with the management and disposal of this waste stream. There are at least three causes that contribute to this situation:

- *Poor Lead Time on the Purchase of New Chemicals*
- *Perceived 90 day limit on disposal of excess chemicals*
- *Read access to ACIS*

Generating Process Alternatives

A brain storming tool was used by the team to generate possible alternatives to the problem. The alternatives that resulted from this activity are as follows:

1. Perform year clean outs of surplus chemicals to provide a metric to measure against to enable continuous improvement and to reduce disposal costs.
2. Provide awards or other incentive to groups that significantly reduce the amount of excess chemicals generated.
3. Give everyone read access to ACIS so individuals can check to see if they can borrow a chemical from the "lab next door" instead of purchasing new chemicals.
4. Improve the ACIS database interface to make it more user friendly and encourage its use.
5. Have chemicals assigned to a room number when they are ordered through JIT to eliminate the effort needed to assign room numbers once the chemicals are received.
6. Have barcode readers available at the Waste Management Coordinators office to encourage people to perform more frequent inventories.

7. Improve the lead time on chemicals. Same day or 2 day delivery of common chemicals would minimize stockpiling needs.
8. Provide student training to ensure students are familiar and use ACIS prior to the purchase of new chemicals.
9. Clarify whether or not an excess chemical is subject to the 90 day disposal requirement.

Selecting an Alternative

The team used a forced pair comparison to select alternatives that should be implemented in the near term. The final ordering was reviewed by the group and is presented below.

1. Perform yearly clean outs of surplus chemicals to provide a metric to measure against to enable continuous improvement and to reduce disposal costs.
2. Improve the lead time on chemicals. Same day or 2 day delivery of common chemicals would minimize stockpiling needs.
3. Clarify whether or not an excess chemical is subject to the 90 day disposal requirement.
4. Give everyone read access to ACIS so individuals can check to see if they can borrow a chemical from the “lab next door” instead of purchasing new chemicals.
5. Have barcode readers available at the Waste Management Coordinators office to encourage people to perform more frequent inventories.
6. Improve the ACIS database interface to make it more user friendly and encourage its use.
7. Have chemicals assigned to a room number when they are ordered through JIT to eliminate the effort needed to assign room numbers once the chemicals are received.
8. Provide student training to ensure students are familiar and use ACIS prior to the purchase of new chemicals.
9. Provide awards or other incentive to groups that significantly reduce the amount of excess chemicals generated.

Action Plan

The team decided to implement alternatives 1 through 7 at this time. The following action plan was prepared by the team to implement the chosen alternatives:

Action Item	Organization	Due Date	Comments
Perform a clean out of surplus chemicals	C-All, E-ET	7/1/01	Continue Annually
Improve lead time on chemicals	ESO	2/1/02	Depends on JIT Contract
Clarify 90 day disposal requirement	ESO	9/1/01	
Give everyone read access to ACIS	ESO	9/1/01	Maybe Security Issues
Have barcode readers available at the WMCs office	ESO	10/1/01	
Improve the ACIS database interface	ESO	NA	New Software Currently in the works. ESO will work with ESH on interface.
Have chemicals assigned to a room number at the time of ordering	ESO	2/1/02	

Continue to perform yearly clean outs of surplus chemicals. Use the metrics from these clean outs to measure performance and ensure continuous improvement.